



**Draft Technical Guidance
Manual for the Proposed
Aircraft Drinking Water Rule
(ADWR)**

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Purpose of this Document

This document provides guidance and contains EPA's current policy recommendations for complying with the Aircraft Drinking Water Rule, to the extent that it is finalized as proposed.

The statutory provisions and the final regulations described in this document contain legally binding requirements. This document is not a regulation itself, nor does it change or substitute for those provisions and regulations. Thus, it does not impose legally binding requirements on EPA or public water systems. This guidance does not confer legal rights or impose legal obligations upon any member of the public.

While EPA has made every effort to ensure the accuracy of the discussion in this guidance, the obligations of the regulated community are determined by statutes, regulations, or other legally binding requirements. In the event of a conflict between the discussion in this document and any statute or regulation, this document would not be controlling.

The general description provided here may not apply to a particular situation based upon the circumstances. Interested parties are free to raise questions and objections about the substance of this guidance and the appropriateness of the application of this guidance to a particular situation. EPA and other decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from those described in this guidance, where appropriate.

Mention of trade names or commercial products does not constitute endorsement or recommendation for their use.

This is a living document and may be revised periodically without public notice. EPA welcomes public input on this document at any time. Guidance provided in this document reflects provisions of the proposed rule published April 9, 2008 at 73 FR 19320 and will be revised to reflect the provisions in the final rule after it is issued.

Table of Contents

CHAPTER 1	INTRODUCTION	1
1.1	Purpose, Applicability, and General Requirements of the Proposed Aircraft Drinking Water Rule.....	1
1.2	Intended Use of this Document.....	3
1.3	Intended Audience for this Document	3
1.4	Outline of this Document.....	4
CHAPTER 2	OVERVIEW OF THE RULE.....	6
2.1	What is an Aircraft Public Water System?	6
2.1.1	<i>Types of Public Water Systems</i>	6
2.1.2	<i>Components of Aircraft Public Water Systems</i>	6
2.2	Public Health Protection and the Aircraft Drinking Water Rule	8
2.2.1	<i>Public Health Threats Addressed by the Rule</i>	8
2.2.2	<i>ADWR Public Health Protection Measures</i>	10
2.3	Compliance Dates and Requirements	10
CHAPTER 3	AIRCRAFT INVENTORY	14
3.1	Identifying Aircraft Public Water Systems.....	14
3.2	Reporting Existing Inventory Information.....	15
3.2.1	<i>Inventory Details</i>	15
3.2.2	<i>Inventory Reporting Format and Procedure</i>	16
3.3	Reporting Inventory Updates.....	16
CHAPTER 4	COLIFORM MONITORING	17
4.1	Overview of Coliform Sampling	17
4.1.1	<i>Types of Coliform Samples</i>	17
4.1.2	<i>Sequence of Coliform Sampling</i>	18
4.2	Coliform Sampling Plans.....	20
4.3	Sampling Frequencies	22
4.4	Suggested Sampling Protocol	22
4.4.1	<i>Materials and Preparation for Sampling</i>	22
4.4.2	<i>Sample Collection</i>	23
4.5	Certified Laboratories and Analytical Methods.....	24
4.5.1	<i>Analytical Methods</i>	24
4.5.2	<i>Sample Invalidation</i>	24
4.6	Reporting Sampling Results	25

CHAPTER 5	OPERATIONS AND MAINTENANCE PLANS	27
5.1	Overview of Requirements and Timeframes	27
5.2	Routine and Corrective Disinfection and Flushing.....	29
5.3	Training of Personnel.....	31
5.4	Procedures for Conducting Self-Inspections	32
5.5	Practices and Procedures for Boarding Water	33
5.5.1	<i>Routine Practices</i>	33
5.5.2	<i>Procedures for When Water of Unknown Quality or Contaminated Water Must be Boarded</i>	35
CHAPTER 6	PUBLIC NOTIFICATION	36
6.1	Purpose of Public Notification.....	36
6.2	Notification of Passengers and Crew	36
6.2.1	<i>Public Notice Methods and Timing</i>	37
6.2.2	<i>Public Notice Format and Content</i>	38
6.3	Required Language for Public Notification.....	39
6.3.1	<i>Detection of total coliforms only (not fecal coliforms or E. coli)</i>	39
6.3.2	<i>Routine or Repeat Sample Positive for E. coli or Fecal Coliform</i>	40
6.3.3	<i>Failure to Monitor, Improper Testing Procedures, or Failure to Disinfect and Flush</i>	40
6.4	Public Address Announcement for Positive E. coli Samples	40
CHAPTER 7	RECORDKEEPING AND REPORTING	42
7.1	Air Carrier Recordkeeping.....	42
7.2	Reporting Requirements	43
7.2.1	<i>Coliform Sampling and O&M Plans</i>	43
7.2.2	<i>Aircraft Inventory</i>	44
7.2.3	<i>Coliform Sampling Results and Violations</i>	44
7.2.4	<i>Self-Inspection and Compliance Audit Results</i>	44
CHAPTER 8	VIOLATIONS OF THE RULE	46
CHAPTER 9	SUGGESTED ENGINEERING AND MANAGEMENT PRACTICES ..	49
9.1	Maintaining Water Quality	49
9.2	Considerations for Supplemental Treatment	50
9.3	Considerations for Supplemental Operator Training and Maintenance	51
9.4	Considerations for Supplemental Recordkeeping.....	51
REFERENCES	53

List of Tables

Table 2.1	Rule Components and Compliance Dates.....	10
Table 4.1.	Coliform Sampling Frequencies Based on Disinfection and Flushing Frequencies	22
Table 5.1	Typical Disinfectants Used for Aircraft Water Systems.....	29

List of Exhibits

Exhibit 2.1	Aircraft Onboard Water System	7
Exhibit 2.2	Potential Contamination Pathways within the Aircraft Water System Supply and Transfer Chain	9
Exhibit 4.1	Overview of Coliform Monitoring Requirements	19
Exhibit 7.1	Example Format for Disinfection and Flushing Records	43
Exhibit 8.1	Violations of the ADWR	47

Acronyms and Abbreviations

ADWR	Aircraft Drinking Water Rule
ANSI	American National Standards Institute
AOC	Administrative Order on Consent
ATA	Air Transport Association
BMP	Best Management Practice
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CRMP	Comprehensive Representative Monitoring Plan
CWS	Community Water System
DBP	Disinfection Byproducts
EPA	United States Environmental Protection Agency
<i>E. coli</i>	<i>Escherichia coli</i>
FAA	United States Federal Aviation Administration
FDA	United States Food and Drug Administration
FR	<i>Federal Register</i>
GWS	Ground Water System
GWUDI	Ground Water Under the Direct Influence of Surface Water
HACCP	Hazard Analysis Critical Control Point
ICC	Interstate Carrier Conveyance
ICR	Information Collection Request
IESWTR	Interim Enhanced Surface Water Treatment Rule
LIMS	Laboratory Information Management System

mL	Milliliters
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MRDL	Maximum Residual Disinfectant Level
mg/L	Milligrams per Liter
NAICS	National American Industry Classification System
NATA	National Air Transportation Association
NASA	National Aeronautics and Space Administration
NCWS	Non-Community Water System
NDWAC	National Drinking Water Advisory Council
NOV	Notice of Violation
NPDWR	National Primary Drinking Water Regulation
NSF	NSF International
NTNCWS	Non-Transient Non-Community Water System
NTTAA	National Technology Transfer and Advancement Act
O&M	Operations and Maintenance
OMB	Office of Management and Budget
PN	Public Notification
ppm	Parts per Million
PWS	Public Water System
QAPP	Quality Assurance Project Plan
RFA	Regulatory Flexibility Act
SBA	Small Business Administration

SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SWTR	Surface Water Treatment Rule
TC	Total Coliform
TCR	Total Coliform Rule
TNCWS	Transient Non-Community Water System
TT	Treatment Technique
UMRA	Unfunded Mandates Reform Act
WHO	World Health Organization
WSG	Water Supply Guidance
WSP	Water Safety Plan

Chapter 1 Introduction

1.1 Purpose, Applicability, and General Requirements of the Proposed Aircraft Drinking Water Rule

The primary purpose of the proposed Aircraft Drinking Water Rule (ADWR) is to ensure that safe and reliable drinking water is provided to aircraft passengers and crew. This entails providing air carriers with a feasible way to comply with National Primary Drinking Water Regulations (NPDWRs) under the Safe Drinking Water Act (SDWA). Water provided onboard aircraft through lavatory and galley faucets must meet standards for human consumption, which includes uses such as washing face or hands; brushing teeth; consuming coffee, tea, or other beverages made with onboard water; and drinking the water from galley or lavatory water taps. Thus, even if passengers and crew are provided bottled water for drinking, water from aircraft lavatory taps must still meet drinking water standards.

Safe drinking water regulations that pertain to traditional stationary public water systems have proven difficult for owners and operators of aircraft to implement due to the unique characteristics of their water systems. For example, aircraft fly to multiple destinations over the course of one day and may board drinking water at many of these destinations. Because aircraft board water from airport watering points via temporary connections, aircraft drinking water quality depends on a number of factors, including the quality of the water boarded from each source, the care used to board the water, and the operation and maintenance (O&M) of the onboard water system and the water transfer equipment (such as water cabinets, trucks, carts, and hoses). To address these challenges, EPA is amending the NPDWRs through the ADWR and has prepared this guidance document.

The proposed ADWR applies to all aircraft water systems that board only finished water, provide piped water for human consumption, and meet *all* of the following criteria:

- Aircraft that regularly serve an average of at least 25 or more individuals daily at least 60 days out of the year.

By definition, a public water system regularly serves an average of at least 25 or more individuals daily at least 60 days out of the year [40 CFR 141.2]. If the aircraft does not operate at least 60 days each year, or if it does not regularly serve an average of at least 25 people daily at least 60 days in a year, the aircraft would not be a PWS. The 25-person minimum includes the total number of passengers and crew for all of the flights in a day.

- Aircraft with a galley or a qualifying lavatory.

A qualifying lavatory is defined as a private room with a flushing toilet and sink. Curtained-off toilet seats without lavatory sinks (as seen in some small, short-range aircraft) are not considered a qualifying lavatory. An aircraft need only have a galley *or* a qualifying lavatory to meet this criterion.

- Aircraft that fly domestic routes between two or more U.S. locations.
- Aircraft used for passenger conveyance in interstate commerce.

The SDWA and NPDWRs *exclude* from regulation public water systems that: consist only of distribution and storage facilities and do not have any collection and treatment facilities; obtain all water from, but are not owned or operated by, a public water system; do not sell water to any person; and are not a carrier which conveys passengers in interstate commerce [40 CFR 141.3]. If the other exclusion criteria described above are met, the proposed ADWR and other NPDWRs do not apply to aircraft used solely for cargo purposes because they do not convey passengers in interstate commerce.

The proposed requirements of the ADWR are detailed later in this guidance manual. In general terms, the proposed ADWR seeks to protect the quality of drinking water onboard aircraft public water systems by requiring:

- Routine disinfection and flushing of the aircraft water system at a minimum frequency as specified by manufacturers' guidelines. Where manufacturers do not specify a frequency, the proposed rule will require quarterly disinfection and flushing.
- Routine monitoring for total coliform bacteria at aircraft water system taps, at frequencies ranging from monthly to annually, depending on the routine disinfection and flushing frequency.
- Updated aircraft water system operations and maintenance (O&M) plans, which must be incorporated into the air carriers' FAA-approved or accepted O&M program for aircraft. The O&M plans must include a plan for sampling coliform bacteria and performing routine disinfection and flushing, among other requirements.
- Analysis of total coliform-positive samples for the presence of fecal coliform or *Escherichia coli* (*E. coli*).
- Options to conduct either disinfection and flushing of the aircraft water system or repeat monitoring for total coliform bacteria (in some cases) when routine samples contain total coliform.

- Corrective disinfection and flushing of the aircraft water system under some circumstances.
- Follow-up sampling and analysis for total coliform to confirm the effectiveness of corrective disinfection and flushing.
- Public notification for violations including failure to disinfect and flush, a fecal coliform/*E. coli*-positive sample, or failure to monitor for total coliform.
- Comprehensive self-inspection of each aircraft's water system components no less than every 5 years.
- Compliance audits at an interval determined by the United States Environmental Protection Agency (EPA).
- Reporting and recordkeeping associated with the activities described above.

1.2 Intended Use of this Document

This guidance is intended to help facilitate compliance with and implementation of the requirements of the ADWR when final. It explains the applicability of the rule to aircraft water systems and describes the rule requirements. It also recommends sampling procedures that ensure accurate sampling results and maintenance procedures that help preserve good water quality onboard the aircraft. This manual also provides templates for the various public notices required by the proposed rule. While the rule will not be in effect until it is final, this guidance is intended to explain the provisions in the proposed rule and how it will likely be implemented if finalized as proposed. EPA will update and revise this guidance document, prior to issuance, to reflect the text of the final rule.

While EPA has made every effort to ensure the accuracy of the discussion in this document, the obligations of the regulated community are determined by statutes, regulations, or other legally binding requirements. In the event of a conflict between the discussion in this document and any statute or regulation, this document would not be controlling.

1.3 Intended Audience for this Document

This manual is intended for aircraft industry professionals and air carrier employees who need to be familiar with the proposed rule requirements. This may include air carrier and airport owners and managers, pilots, flight attendants, fixed based operators, and maintenance staff.

1.4 Outline of this Document

The guidance manual is organized as follows:

Chapter 1. Introduction – Explains the purpose of this manual.

Chapter 2. Overview of the Aircraft Drinking Water Rule – Describes rule requirements and compliance dates, as well as key background information.

Chapter 3. Aircraft Inventory – Explains recordkeeping requirements related to aircraft inventory.

Chapter 4. Coliform Monitoring – Describes coliform monitoring requirements including monitoring plan content, sampling locations, sampling frequency, sampling protocol, analytical methods, and reporting requirements. The chapter also discusses repeat sampling activities.

Chapter 5. Operations and Maintenance Plans – Discusses the requirements for an operations and maintenance (O&M) plan, conducting routine disinfection and flushing, performing water system inspections, and training personnel on the public health implications of their activities regarding the water system and how to perform aircraft water system O&M.

Chapter 6. Public Notification – Describes public notice requirements including methods, timing, format, and required language.

Chapter 7. Recordkeeping and Reporting – Describes the requirements for reporting information to the EPA, including inventory information and compliance data, and internal recordkeeping requirements for the air carriers.

Chapter 8. Violations of the Rule – Summarizes rule violations and corrective actions for returning to compliance.

Chapter 9. Suggested Engineering and Management Practices – Describes proactive measures that are above and beyond regulatory requirements and that may contribute additional protection to obtaining and maintaining drinking water quality. Topics include recordkeeping for boarding water, disinfectant residual monitoring, booster disinfection, biofilm management, and supplemental treatment options.

References. Provides a bibliographic list of references cited in this manual.

Appendix A. Proposed Rule Language – The proposed rule as published in the Federal Register. [NOT INCLUDED IN THIS VERSION OF THE DOCUMENT]

Appendix B. Public Notification Templates – Provides example language for various public notices required as a result of a rule violation. [NOT INCLUDED IN THIS VERSION OF THE DOCUMENT]

Appendix C. Quick Reference Guide – A stand-alone fact sheet that summarizes rule requirements and key background information. [NOT INCLUDED IN THIS VERSION OF THE DOCUMENT]

Appendix D. Aircraft Self-Inspection Guide – Provides a discussion of the essential elements of an aircraft self-inspection and includes an example checklist for a self-inspection procedure. [NOT INCLUDED IN THIS VERSION OF THE DOCUMENT]

Chapter 2 Overview of the Rule

2.1 What is an Aircraft Public Water System?

2.1.1 Types of Public Water Systems

The National Primary Drinking Water Regulations (NPDWRs) define a public water system (PWS) as a system for providing piped water for human consumption to the public that regularly serves an average of at least 25 individuals daily, at least 60 days per year [40 CFR 141.2]. All public water systems are subject to the NPDWRs unless they are exempted by the Safe Drinking Water Act (SDWA) Section 1411. Section 1411 excludes from regulation any PWS that receives all its water from another regulated PWS, does not sell or treat the water, and is not a “carrier which conveys passengers in interstate commerce.” Thus, because aircraft involved in interstate commerce are not exempt from the SDWA, they are regulated public water systems. This applicability requirement is also found in 40 CFR 141.3. The classes of ICCs include aircraft, trains, buses, and water vessels.

PWSs are subject to different subsets of the NPDWRs based on the type of population they serve. The two main subsets are community water systems and non-community water systems. Community water systems primarily serve residential populations; non-community systems primarily serve nonresidential users. Non-community water systems are further divided based on whether they regularly serve the same people for more than 6 months per year, such as schools or workers at a business or industry. If the same people are served, the system is classified as a non-transient non-community water system (NTNCWS). If different people are served, as occurs at restaurants or highway rest stops, the system is classified as a transient non-community water system (TNCWS).

Aircraft public water systems are regulated as TNCWSs because they are non-community water systems that do not regularly serve at least 25 of the same people over six months per year. Because TNCWSs serve a transient population, they are subject only to regulations that address acute health effects resulting from short term exposure. Acute health effects are impacts on health which occur over a short period of time after exposure to the contaminant. The ADWR is designed to address such health risks.

2.1.2 Components of Aircraft Public Water Systems

The ADWR applies to the onboard water system only. The components of an aircraft water system include the water service panel, the filler neck of the aircraft finished water storage tank, the onboard water storage tank(s), piping, treatment equipment, galley and lavatory faucets, galley coffee makers, and any other plumbing fixtures that supply water to passengers or crew. A schematic of an aircraft water system is shown in Exhibit 2.1.

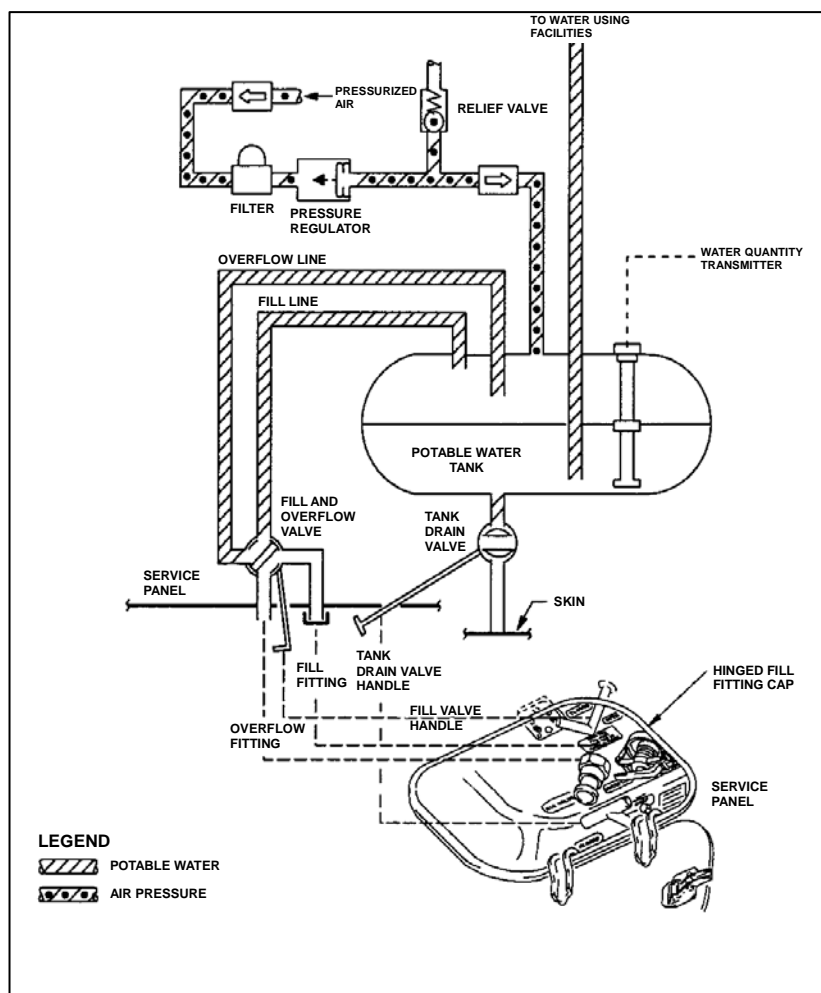


Exhibit 2.1 Aircraft Onboard Water System

Water is supplied to the aircraft through a fill port. Water is drained from the water system through a drain port on the underbelly of the aircraft. The water system may be pressurized using bleed air from the operation of the aircraft engines or an on-demand electric pump.

Aircraft water systems vary depending on the type of aircraft. Onboard storage tank capacity varies from 5 gallons in a regional jet to 360 gallons in a Boeing 777. Various piping configurations in the galley may include separate lines for the sink and a hot water tap located on the coffee maker. Some aircraft have carbon filters on the supply line to the coffee makers, which should be replaced according to the manufacturer's recommendations.

The aircraft water system may also include some protective devices to meet sanitation requirements, such as air filters in bleed-air lines and at compressor inlets for protection from contaminants; self-venting valves in galley and lavatory supply lines to help drain the system; and air gaps between the water supply and the drain system.

Many aircraft have two separate water systems – one in the forward section of the aircraft for a galley and a lavatory, and one system in the rear of the aircraft for a galley and/or lavatory. The ADWR requirements apply to each aircraft, regardless of the number of separate water systems on board. Chapter 4 describes suggested coliform sampling plans for aircraft with more than one onboard water system.

2.2 Public Health Protection and the Aircraft Drinking Water Rule

2.2.1 Public Health Threats Addressed by the Rule

Aircraft water systems that are subject to this rule board finished water (water that requires no further treatment) from a public water system owned either by the airport or the city that serves the airport. Finished water from a regulated PWS is delivered to the airport terminals and is accessible to aircraft and water service providers at watering points approved by the Food and Drug Administration (FDA) [21 CFR 1240.80]. Water is transferred to the aircraft storage tank either by a direct hose connection from a water cabinet mounted on the terminal building or a mobile truck or cart, depending on the aircraft's relative location to the watering point. Small aircraft such as regional jets may not have a service port for filling the onboard storage tank. Instead, these aircraft water systems are equipped with a removable tank (usually 5 gallons) that is refilled at the airport's catering facility.

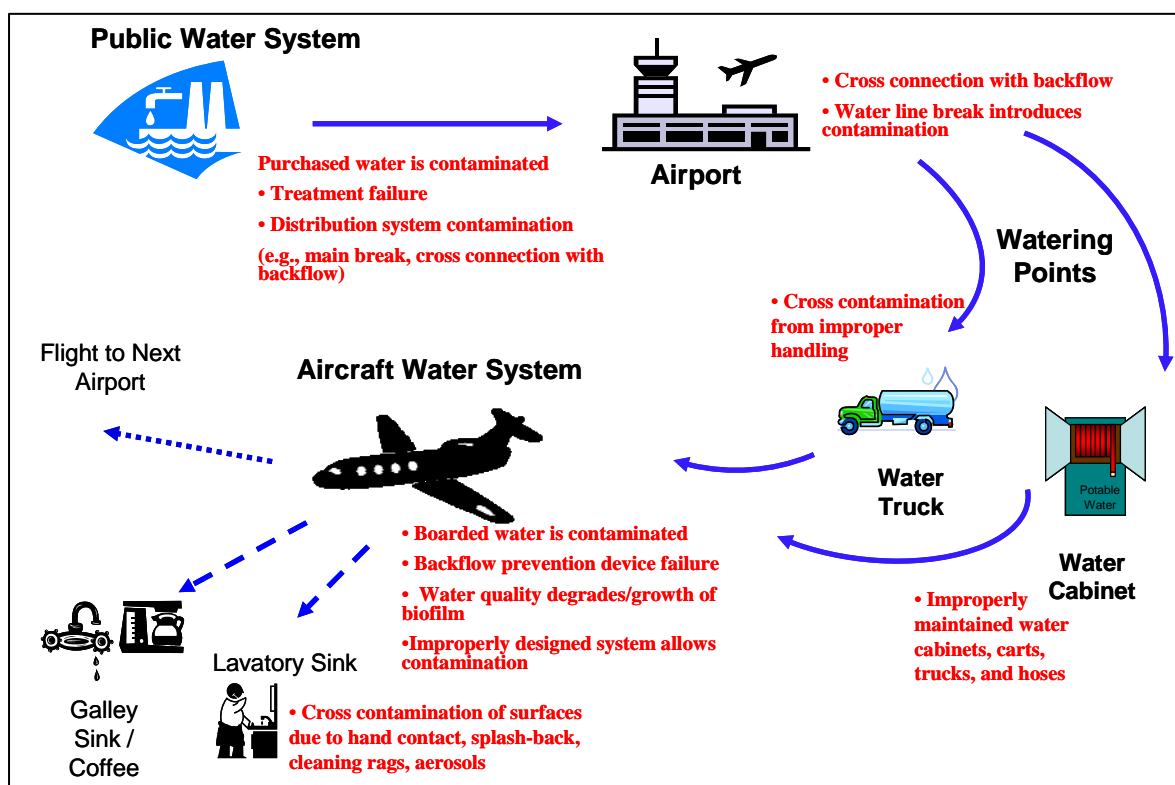
The ADWR seeks to protect against disease-causing microbiological contaminants or pathogens in the drinking water of the onboard water system. Microbiological contamination is a concern because it can occur during the water boarding process if there are problems with the watering point hoses, water transfer equipment, or the sanitary practices employed. Contamination can also occur if an aircraft boards water in a country that has less stringent drinking water standards, or if an aircraft boards water from an airport whose drinking water source is a domestic PWS that is in violation of the drinking water standards. Water quality can also deteriorate if water is held in the airport's distribution system or in the aircraft's water system for too long. As the water ages, coliform bacteria and other bacteria, although generally harmless, can accumulate on pipe and storage tank interior surfaces forming biofilm, a layer of microorganisms that can provide shelter for pathogens if they enter the system.

Because aircraft are transient non-community public water systems, only contaminants that cause acute health effects are of concern. An acute health effect is a brief and severe onset of illness after short-term exposure. Chemicals contaminants that can cause acute health effects include nitrate, nitrite, and high levels of chlorine dioxide. The ADWR assumes chemical contaminants are addressed by the PWS from which finished water is boarded and does not require aircraft to monitor for them. Since finished water is water that is ready for human consumption without further treatment, it must meet all regulatory requirements pertaining to contaminants. An aircraft must, however, provide

public notification and corrective action if water is boarded that is in violation of a drinking water standard. This situation may occur if the aircraft must board water and the only available water is known to violate a NPDWR.

EPA defers to the FDA with respect to regulating watering points such as water cabinets, carts, trucks, and hoses from which aircraft board water. The FDA also approves the design of aircraft water systems and requires that interstate carrier conveyances provide potable water for drinking and culinary purposes [21 CFR 1240.80]. Therefore, additional treatment of the water should not be needed prior to boarding the water. However, the opportunity exists for microbiological organisms to be introduced during the process of boarding water, or for biofilm to develop within the water system itself, which may cause the system to need to be disinfected and flushed. Exhibit 2.2 illustrates potential mechanisms and pathways through which water may be contaminated prior to being boarded, or may become contaminated or deteriorate in quality while onboard the aircraft. The ADWR is intended to minimize such occurrences and prescribe appropriate response actions if they occur.

Exhibit 2.2 Potential Contamination Pathways within the Aircraft Water System Supply and Transfer Chain



2.2.2 ADWR Public Health Protection Measures

With aircraft, it is impractical to test the water for microbiological contaminants every time water is boarded from a different source – several samples may be required in one day for some aircraft, and coliform bacteria analytical results would not be available for at least 24 hours after sample collection. The ADWR therefore requires air carriers to develop a comprehensive operations and maintenance (O&M) plan for each aircraft water system to minimize opportunities for contamination. The plan addresses procedures for routine disinfection and flushing, to be performed at frequencies recommended by the aircraft water system manufacturer. The plan requires occasional testing for total coliform bacteria to confirm the effectiveness of O&M procedures. It also identifies minimum training content and requires training of personnel involved in boarding water and water system maintenance. In the event that an air carrier becomes aware of contamination on an aircraft, the ADWR requires public notification of passengers and crew.

In addition to the O&M plan, the ADWR requires self-inspections by air carriers of each aircraft water system, and allows for EPA compliance audits. Lastly, the rule requires reporting and recordkeeping to facilitate compliance tracking and rule implementation.

2.3 Compliance Dates and Requirements

Several rule components will require implementation six months after rule promulgation; the remainder must be implemented within one year after promulgation. These compliance dates allow the air carriers to be taken off the administrative orders on consent (AOC) under which they operate until the final ADWR is in effect. The rule requirements and compliance dates are summarized in Table 2.1, below, and are described briefly following the table.

Table 2.1 Rule Components and Compliance Dates

6 Months After Rule Promulgation
Submit aircraft water system inventory
Develop coliform sampling plan and report coliform sampling frequency
Update O&M plan to reflect ADWR and report plan is complete
1 Year After Rule Promulgation
Update aircraft inventory and coliform sampling plans as needed for new aircraft
Begin coliform sampling
Begin routine disinfection and flushing
Begin reporting and recordkeeping
Conduct corrective disinfection and flushing as needed

Conduct public notification as needed
Conduct self-inspections (every 5 years) and correct deficiencies

Aircraft Inventory. Air carriers are required to report their fleet inventory for all aircraft water systems to EPA within six months of promulgation of the ADWR. They are required to submit changes in inventory within 10 days after the end of the month in which the changes occurred. Since each aircraft is a PWS, the inventory will include a unique identifier number for each aircraft. Inventory information will be submitted to EPA electronically, in a database format designed by EPA to facilitate subsequent reporting, recordkeeping, and compliance monitoring. Air carriers that have submitted inventories for compliance with AOCs prior to promulgation of the final rule need only update the inventory. See Chapter 3 for more information.

Coliform Sampling Plans. Air carriers must develop coliform sampling plans for existing aircraft within six months after rule promulgation. The sampling plan will include sampling procedures, along with aircraft sampling frequencies and disinfection and flushing frequencies. Air carriers are not required to submit the coliform sampling plan to EPA, but must inform EPA that the plan is complete and submit their planned sampling frequencies. However, EPA may choose to review the plans during a compliance audit, and can request that the plan be submitted at any time. Although the rule requires a sampling plan for each aircraft, individual plan documents are not required for each aircraft – EPA anticipates a plan may be developed that covers several aircraft and specifies the aircraft identifier numbers within the document. For new aircraft, air carriers must develop sampling plans and report coliform sampling frequency within the first three months of operation of the new aircraft. See Chapter 4 for more information.

Operation and Maintenance Plans. Within six months after rule promulgation, air carriers must update their existing Federal Aviation Administration-approved or accepted operations and maintenance programs with aircraft water system operations and maintenance plans. Air carriers need not submit the O&M plans to EPA, but must inform EPA that the plans are complete. EPA can request a copy of the plan at any time and may view the plan during compliance audits. For new aircraft, air carriers must revise the O&M plan and inform EPA that the plan is complete within the first three months of operation. See Chapter 5 for more information.

Self-Inspections. Beginning one year after rule promulgation, air carriers must begin conducting self-inspections of aircraft water systems. Each aircraft water system must be inspected every five years – a frequency consistent with sanitary surveys of stationary TNCWSs and intended to be compatible with other significant aircraft maintenance events. Air carriers must address deficiencies they discover during the inspections within 90 days, and inform EPA of any that are not addressed within this timeframe. See Chapter 5 and Appendix D [APPENDIX D TO BE DEVELOPED] for more information.

Notification to Passengers and Crew. Beginning one year after rule promulgation, air carriers will be required to notify passengers and crew that are on board the aircraft in all of the following situations:

- Public access to the aircraft water system is required to be restricted because any routine or repeat sample is fecal coliform-positive or *E. coli*-positive [40 CFR 141.803(c)(3)], or if more than one routine sample or any repeat sample is total coliform positive even if they are fecal coliform-negative (or *E. coli*-negative) [40 CFR 141.803(c)(4)].
- There has been a failure to collect routine, repeat, or follow-up coliform samples [40 CFR 141.803(e) or (f)].
- Water has been boarded from a watering point that has not been approved by the FDA or otherwise determined to be safe [40 CFR 141.804(b)(6)].
- The EPA, the air carrier, or the crew otherwise determine that notification is necessary to protect public health [40 CFR 141.805(a)(4)].

However, if access to the water system by passengers is physically prevented through disconnecting or shutting off the water, or if water is supplied only to lavatory toilets and not to any lavatory taps, then only the notice to the crew is required. This exception only applies when there is no possibility of the passengers accessing the water system for consumptive use.

Notification is required within 24 hours of being informed of sample results or other events which trigger notification, or within 24 hours of being informed by EPA to perform notification, whichever occurs first. The ADWR does not require notification of passengers that were onboard the aircraft at the time the coliform-positive samples were collected. However, such passengers may be notified if it is directed as part of an illness or event investigation. Notification of passengers and crew must continue until all follow-up samples required by the situation that triggered the notice are coliform-negative. See Chapter 6 for more information.

Recordkeeping and Reporting. Air carriers must keep their coliform sampling plans and O&M plans on hand and make them available for EPA review during compliance audits and upon request. Records of coliform monitoring and disinfection and flushing must be kept for at least five years, and records of self-inspections must be kept for at least 10 years. The rule also specifies a minimum public notice records retention requirement of three years.

In addition to the reporting described previously for aircraft inventory, sampling plans, and O&M plans, the rule requires air carriers to report sample results, self-inspection results, failure to comply with monitoring or disinfection and flushing requirements, and the occurrence of events requiring corrective disinfection and notification of passengers

and crew. This reporting begins starting one year after promulgation; actual reporting deadlines vary. See Chapter 7 for more information on recordkeeping and reporting.

Implementation Oversight and Enforcement. The rule authorizes EPA to conduct onsite compliance audits of aircraft and aircraft records. EPA may review records, take coliform samples, and observe procedures at any time.

Chapter 3 Aircraft Inventory

Under the ADWR, air carriers will be required to submit to EPA an inventory of all aircraft public water systems (PWSs) in their fleet and to update the inventory as fleet changes occur [40 CFR 141.806(b)]. This chapter describes how to identify aircraft that are PWSs, the information to be reported, and how to submit the inventory data.

3.1 Identifying Aircraft Public Water Systems

The criteria that must be met for an aircraft with an onboard water system to be regulated under the ADWR are as follows:

- The water system must provide piped water to the public for human consumption.

“Water for human consumption” means water used for purposes identified under the NPDWRs and accompanying preamble and court decisions, which includes, but is not limited to: drinking, beverage preparation, bathing, showering, hand washing, cooking, dishwashing, and maintaining oral hygiene. Human consumption does not mean water used for toilet uses. If piped water is available to the public onboard an aircraft, then there is human consumption.

- The water system must regularly serve an average of at least 25 individuals daily at least 60 days out of the year.

The aircraft must have at least 60 days of flight in a year and the total number of persons served each day, including passengers and crew, must average at least 25 individuals. The number of persons served includes all flights in a day. A smaller aircraft can still be considered a PWS if it flies at least 60 days a year and serves a total of at least 25 people over the course of a day. That is, if two flights have 20 individuals each, the total number for the day is 40 persons served.

- The aircraft must convey passengers in interstate commerce.

Cargo planes or other aircraft that have a water system on board but are not involved in any passenger conveyance for interstate commerce are not subject to the ADWR.

The ADWR requirements still apply if an aircraft provides bottled drinking water for drinking purposes if there is an onboard water system available for human consumption.

3.2 Reporting Existing Inventory Information

3.2.1 Inventory Details

Within the first six months after rule promulgation, air carriers must provide EPA a complete inventory of aircraft PWSs. EPA may request additional information; however, inventory data must include *all* of the following:

- The unique aircraft identifier number
 - This may be the nose or tail number that is unique to the aircraft and is used for other aircraft tracking requirements.
- The status of the aircraft as active or inactive
 - An active aircraft is one that is actively used for passenger service at least 60 days a year and could therefore reasonably be expected to meet the monitoring, disinfection and flushing, and other requirements of the ADWR.
 - An inactive aircraft is one that is not in service often enough to qualify as a public water system, i.e., it does not operate at least 60 days a year serving 25 or more people.
- The type and location of any treatment equipment installed on the aircraft water system.
 - Treatment equipment includes supplemental disinfection systems, carbon or particle filters on water lines, or other apparatus that changes the chemical, biological, or physical condition of the water. Although it is possible for increased temperature to cause changes to the chemical, biological, and physical condition of water, for the purposes of aircraft inventory hot water heating units on coffee makers and/or hot water lines are not listed as water treatment equipment.
- Whether the aircraft water system can be shut off and the extent to which it can be made inaccessible to the passengers and crew.
 - The ability to shut-off the supply of water to all faucets and other plumbing fixtures affects the requirements for public notification and the timeframe for implementation of corrective disinfection and flushing following a single fecal coliform or *E. coli*-positive sample, or following more than one total coliform positive sample in any monitoring period. If the water cannot be shut off, corrective disinfection and flushing must occur within 72 hours. If the system can be shut off, the aircraft must perform disinfection and flushing prior to resuming unrestricted public access as defined in §141.803(c)(5). Public notification need only be provided to the crew if the water system is shut off to prevent access by the passengers.

3.2.2 Inventory Reporting Format and Procedure

Electronic reporting of inventory data is required. To facilitate collection and analysis of aircraft water system data, EPA is developing an internet-based electronic data collection and management system. Inventory will be reported directly to this database using Web forms and free software. The data system will perform logic checks on data entered and will calculate final results for accountability and regulatory oversight. This is intended to reduce reporting errors and limit the time involved in investigating, checking, and correcting errors at all levels.

PLACEHOLDER FOR ADDITIONAL TEXT FOLLOWING DEVELOPMENT OF THE DATABASE:

- Description of spreadsheet format and reporting method
- Accessing the downloadable spreadsheet
- What to do if inventory was submitted for an AOC

3.3 Reporting Inventory Updates

After the initial inventory submission, changes in aircraft inventory must be reported to EPA no later than 10 days following the calendar month in which the change occurred. This includes changes to an aircraft's identifier number, active status, treatment equipment, or ability to shut off the water to passengers. This also includes adding a new aircraft to the fleet. Prompt notification of inventory changes is necessary to ensure violations are not incurred by aircraft that are out of service or otherwise inactive, and that new aircraft are in compliance with the rule.

Note this reporting requirement for inventory updates is different than the requirement for new aircraft coliform sampling plans and operations and maintenance plans, which must be completed and reported within the first calendar quarter of operation of the aircraft.

PLACEHOLDER FOR ADDITIONAL TEXT FOLLOWING DEVELOPMENT OF THE DATABASE:

- Reporting format
- Method for inventory changes

Chapter 4 Coliform Monitoring

4.1 Overview of Coliform Sampling

Coliforms are used as an indicator of possible contamination of the water system. They are used to indicate a water system's vulnerability to pathogens, and are required to be monitored by every public water system.

4.1.1 Types of Coliform Samples

Coliform samples required by the ADWR are of three types: routine samples, repeat samples, and follow-up samples.

Routine samples are collected on a specified schedule, which is determined by the frequency of routine disinfection and flushing of the water system. For routine sampling, two samples of 100 milliliters (mL) each must be taken, one from a galley and one from a lavatory tap. If the aircraft has only one tap, two 100-mL samples must be taken from that tap. The ADWR does not specify whether samples should be collected from hot or cold taps, but EPA strongly recommends collection of samples from cold water taps. Some concern exists about sampling from hot taps since hot water could kill microorganisms, masking whether there is a microbiological problem in the aircraft system. In addition, water lines that are connected to hot water heaters may be warmer than cold water piping, which often encourages microbial growth within those lines.

Repeat samples are an option to performing corrective disinfection and flushing of the system when only one routine sample is total coliform-positive and it is also fecal coliform/*E. coli*-negative. For repeat sampling, four repeat samples of 100 mL each must be collected no later than 24 hours after the laboratory notifies the air carrier of the routine sample results. If the option to collect repeat samples is selected, a set of four repeat samples must be collected and analyzed from four taps within the aircraft as follows: the tap that resulted in the total coliform-positive routine sample, one other lavatory tap, one other galley tap, and one other tap. If less than four taps exist, then a total of four 100 mL samples must be collected and analyzed from the available taps within the aircraft water system.

Follow-up samples are a set of two coliform samples used to confirm the effectiveness of corrective disinfection and flushing procedures. Follow-up samples (two samples of 100 mL each) must be taken at the same locations as routine sampling. Follow-up sampling is required after corrective disinfection and flushing, or disinfection and flushing triggered by failure to perform routine coliform monitoring. Although the ADWR does not specify a timeframe by which follow-up samples must be collected, a complete set of two follow-up samples must be coliform-negative before public access to the water is allowed.

Aircraft may also voluntarily collect special purpose samples as needed to indicate the quality of the onboard water. The routine and repeat coliform sampling requirements of the ADWR are summarized below and are detailed in 40 CFR 141.803.

4.1.2 Sequence of Coliform Sampling

Each aircraft PWS must be routinely monitored for total coliform at the frequency specified in the coliform sampling plan for that aircraft. During each monitoring period – which may be monthly, once per quarter, or once per year – a set of two routine samples must be collected. In order to provide meaningful results, routine coliform sampling should be representative of the general conditions of the aircraft water system. That is, they should represent water provided to passengers and crew on a typical flight. To ensure that routine sample results are not inadvertently skewed by sampling too close to a disinfection event, routine coliform samples must not be collected within 72 hours after completing disinfection and flushing procedures.

If any sample is positive for total coliform, that sample must be analyzed for *E. coli* or fecal coliform bacteria. *E. coli* and fecal coliform are considered indicators of fecal contamination. If either of these is present in any sample, public access to the water system must be restricted, public notice must be provided, and corrective disinfection and flushing with follow-up coliform sampling must be performed. All follow-up samples must be coliform-negative before unrestricted public access to the water system is allowed.

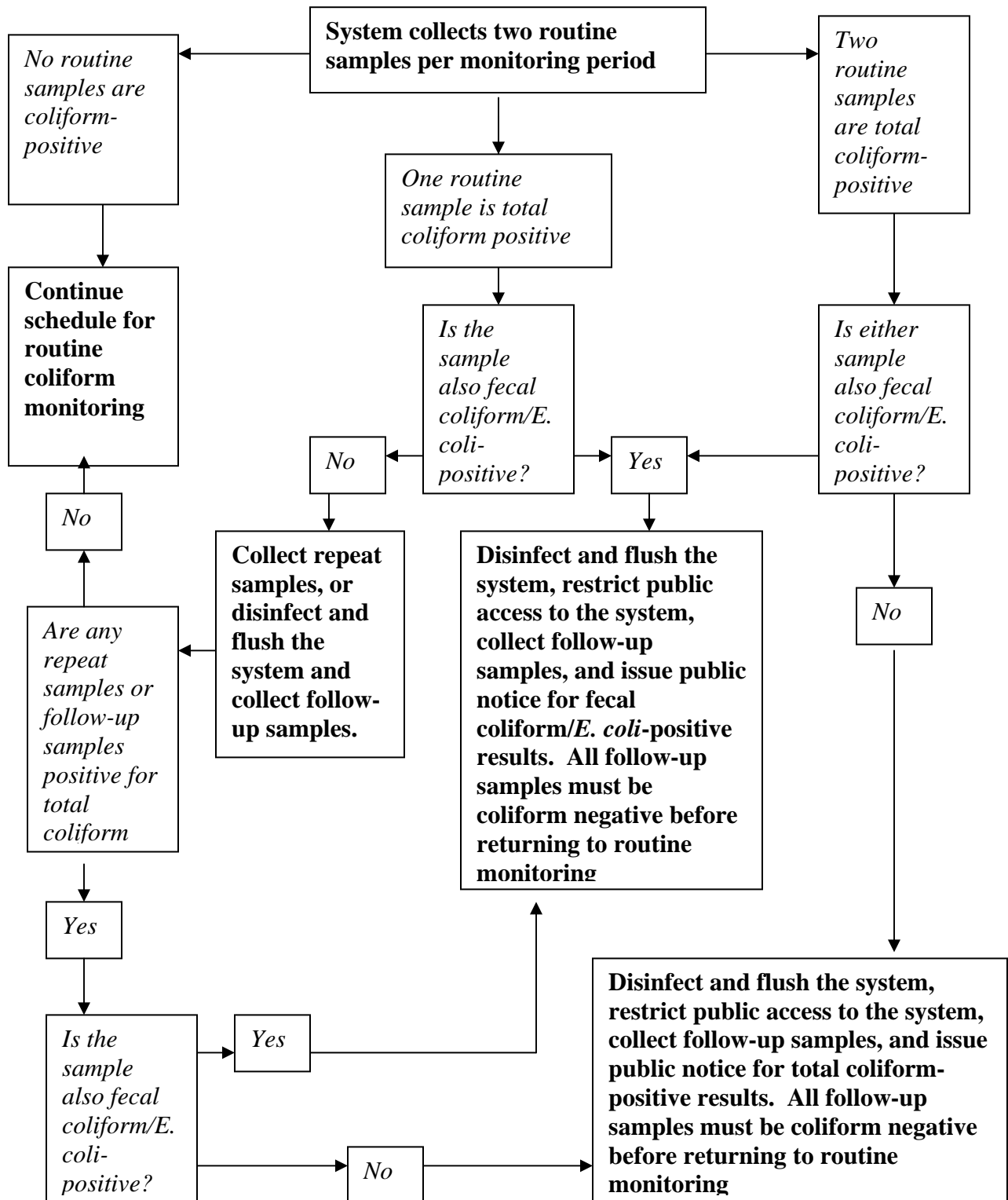
If total coliform bacteria are not detected in any routine samples in a monitoring period, the aircraft must continue collecting routine samples for total coliform analysis at the frequency specified in the coliform sampling plan.

If one routine sample is positive for total coliform and it is also fecal coliform/*E. coli*-negative, the aircraft may either collect four repeat samples or choose to disinfect and flush the water system and collect a set of two follow-up samples.

If both routine samples are positive for total coliform, the option for collection of repeat samples is removed and the aircraft must restrict public access to the water system including providing notice to the passengers and crew, disinfect and flush the water system, and collect follow-up samples. These actions are also required if any repeat samples are positive for total coliform but are fecal coliform/*E.coli*-negative.

Exhibit 4.1 provides a diagram of the coliform monitoring requirements of the ADWR.

Exhibit 4.1 Overview of Coliform Monitoring Requirements



4.2 Coliform Sampling Plans

Within six months after rule promulgation, each aircraft must be covered by a coliform sampling plan. The sampling plan ensures representative and meaningful samples are collected from each aircraft. A separate plan does not need to be developed for each aircraft. EPA recommends a plan be developed for each *type* of aircraft and that the plan include a table with the unique aircraft identifier numbers to which the plan applies.

Once completed, EPA must be notified that the coliform sampling plan has been prepared and the plan must be included in the aircraft O&M program. If additional aircraft are added to the fleet, EPA must be notified that a sampling plan has been completed for the new aircraft by the end of the calendar quarter in which the aircraft begins operation. New aircraft may be added to the list of aircraft covered by an existing plan, or a new plan may be developed. EPA notification will utilize the electronic reporting and compliance database described in Chapter 7.

At a minimum, all coliform sampling plans must include the following [40 CFR 141.802]:

- Coliform sample collection procedures

Standardized procedures ensure representative samples are collected and meaningful samples results will be obtained. Suggested procedures are included in section 4.4.

- Sample tap location(s) representative of the aircraft water system

Identification of sample taps from which specific samples are collected provides useful information for follow-up investigations. For example, an air carrier reported to EPA that being able to identify the specific sample location from which coliform-positive samples were collected helped detect problematic faucets. Once the specific faucets were identified and replaced, persistent coliform-positive sample problems were eliminated for that aircraft.

Identifying sample taps as to whether they are fore or aft, lavatory or galley, and other details helps identify the specific location from which a sample was collected. When this location information is entered on the coliform sample form submitted to the laboratory, the sample results will also be reported with the location.

The ADWR specifies two routine samples must be taken during each routine monitoring period for each aircraft that qualifies as a public water system. Some aircraft may have more than one water tank and plumbing system, all of which may not be interconnected. In such situations, EPA recommends all drinking water tanks and plumbing on an aircraft be included in the coliform sampling plan, and that the sample locations be alternated between the discreet systems

each sampling period so as to collect representative samples to the extent possible. For example, an aircraft on quarterly coliform monitoring might have a lavatory sample collected from the forward system and a galley sample collected from the rear system in one quarter, and collect second quarter samples from the forward galley and rear lavatory. Systems with a single water system may also move the sample locations each monitoring period if necessary to collect representative samples. Identification of sample collection locations in the coliform sampling plan is required by 40 CFR 141.802(a)(2).

- Frequency and number of routine coliform samples to be collected

Making note of the required frequency and number of samples to be collected helps ensure personnel responsible for this task will collect the correct number of samples during the appropriate monitoring period. The frequency of sample collection means whether the samples are collected monthly, quarterly, or once per year. All aircraft must collect two routine samples during each monitoring period. These are collected from different locations on the aircraft if more than one tap is available, but they are both collected during the same sampling event. Aircraft have the option to collect more than two samples during each monitoring period if desired.

- Frequency of routine disinfection and flushing as specified in the operation and maintenance plan

The frequency of routine disinfection and flushing of the aircraft water system determines the minimum frequency for routine coliform sample collection. Including the disinfection and flushing frequency in the coliform sampling plan helps ensure the proper frequencies are followed, and that both activities are performed.

- Procedures for communicating sample results to ensure any required actions are conducted in a timely manner

The first step in the communications process is the notice the laboratory performing the coliform analyses provides to the air carrier regarding the sample result. Notification of both positive and negative sample results in a timely manner is critical to ensure the required action may be promptly implemented. Required actions may include repeat or follow-up sampling, restricting public access, corrective disinfection and flushing, notification of passengers and crew, or returning to unrestricted access to the water. EPA suggests that communications procedures include specific contact personnel names, phone numbers, and back-up contact information.

4.3 Sampling Frequencies

Routine coliform sampling frequencies depend on the frequency at which routine disinfection and flushing is conducted. Routine disinfection and flushing must be conducted at the frequency recommended by the manufacturer of the aircraft water system. If the manufacturer does not recommend a frequency, routine disinfection and flushing must be performed no less frequently than quarterly. Table 4.1 shows the monitoring frequency that corresponds with a given disinfection frequency. Additional, or special, coliform sampling is always encouraged and recommended by EPA.

Table 4.1. Coliform Sampling Frequencies Based on Disinfection and Flushing Frequencies

Disinfection and Flushing Frequency	Routine Coliform Sampling Frequency
Quarterly	Annually
1-3 Times a Year	Quarterly
Less Than Once a Year	Monthly

4.4 Suggested Sampling Protocol

The following is a suggested sampling protocol that could be used for collection of routine, repeat, or follow-up samples.

4.4.1 Materials and Preparation for Sampling

Contact the laboratory that will perform sample analysis in advance of the planned sampling date. Sufficient time should be allowed to obtain materials and to agree on a sample submittal date.

The laboratory should be notified of the number of sample bottles needed, and it should be determined whether the laboratory will provide a return-shipping cooler and ice packs (although shipping the sample on ice to obtain a shipping temperature of 10 degrees C or less without freezing the sample is recommended, it is not a requirement of the ADWR). All materials should be on-hand and ready for use at least 48 hours prior to sampling. Note that a separate cooler or holding container for each day/location of sample collection will be needed if samples are not hand-delivered to the laboratory each day.

Below is a list of suggested materials needed for sampling.

- 1) Data sheet
- 2) Copy of this protocol
- 3) Laboratory chain of custody form
- 4) Indelible pen

- 5) Sample bottles –100-mL sterile plastic with non-toxic cap
- 6) Cooler with ice (optional) (contained-ice packs are preferable to ice cubes)
- 7) Rubbing alcohol (isopropyl alcohol) and cotton swabs, or prepared alcohol wipes
- 8) Rubber / latex exam gloves

Pre-label all bottles with the following information:

- Sample ID correlating to the sample tap location and other information listed on the laboratory chain of custody form and data sheet
- Date and time of collection
- Analyses requested (e.g., total coliform)
- Sampler's initials

On each aircraft, total coliform samples must be collected from a galley tap and a lavatory tap unless there is only one tap. Galley samples should be collected from a cold water tap if possible. If the only sampling point in the galley is the coffee maker and/or hot water tap, collect the sample at that location and indicate the sampling location on the data sheet. Ask ramp personnel to refrain from servicing the aircraft water system until completion of sampling. This will help ensure the sample is representative of the water available to passengers and crew during normal operating conditions; sampling the water system immediately after filling the system would not be representative of the water that had been available to consumers.

During sampling, rubber gloves should be used when handling samples to minimize sample contamination and exposure to sample preservatives. Bottles should be kept closed until ready to be filled.

4.4.2 Sample Collection

The following steps are recommended for routine, repeat, and post-disinfection follow-up sample collection.

- 1) Put on gloves.
- 2) Inspect galley faucet for aerator on outlet. If an aerator is present, remove if possible, clean, and re-install.
- 3) Swab galley faucet and water outlet with alcohol.
- 4) Allow to air dry.
- 5) Open tap fully and allow water to run for 2 to 3 minutes.
- 6) Reduce water flow to allow sampling of water without splashing out of container. Do not sample from leaking taps or taps which allow water to run down the outside of the faucet.
- 7) Open sterile cap of total coliform sample bottle.
- 8) Do not touch interior of cap or top of bottle. Do not place cap on counter.
- 9) Place bottle under water stream. Allow approximately 1-inch air gap between top of bottle and water faucet.
- 10) Do not rinse bottle. Do not fill bottle to top. Allow 1-inch air gap in top of bottle.

- 11) Replace cap and tighten.
- 12) Ensure that sample ID matches that recorded on data sheet.
- 13) Place bottles into Ziploc® or similar bag. Place bag in cooler or other transport container (packing the sample on ice is recommended, but optional)
- 14) Complete chain of custody sheet provided by laboratory. Ensure that sample ID matches that on the label and data sheet. If chain of custody sheet is not provided in duplicate, photocopy it for your records.
- 15) Sign and date the following statement on the data sheet. If there was any deviation from protocol, note at the bottom of data sheet.

I certify that all samples were collected in accordance with the protocol entitled “Protocol for Sampling Drinking Water on Commercial Aircraft”.

Signature

Date

4.5 Certified Laboratories and Analytical Methods

4.5.1 Analytical Methods

EPA interprets the proposed ADWR as including a requirement that a certified laboratory be used for all coliform sample analyses, and a maximum holding time between sample collection and analysis for coliform samples of 30 hours.

EPA-approved analytical methodologies must be used for the analysis of coliform bacteria and *E. coli*. The current list of approved analytical methods is provided on EPA’s website at <http://www.epa.gov/safewater>. For compliance with the ADWR, methods approved for compliance with the Total Coliform Rule are also appropriate. Each sample need only be analyzed for the presence or absence of the organisms; enumeration of the bacterial colonies present is not necessary.

EPA strongly recommends using methods that provide the most rapid test results and include simultaneous total coliform and fecal coliform/*E. coli* test results. Discuss with the laboratory the test methods they are certified to perform and the anticipated timeframe for reporting results, as well as their procedure for reporting results. Because of the availability of overnight shipping, the preferred laboratory may not be the one closest to the sampling location.

4.5.2 Sample Invalidation

The invalidation of a total coliform sample result can only be made by EPA in accordance with 40 CFR 141.21(c)(1)(i), (ii), or (iii) or by the State- or EPA-certified laboratory in accordance with 40 CFR 141.21 (c)(2). If an air carrier believes that a result is incorrect, they may submit the result as a contested result and petition EPA to

invalidate the sample. If an air carrier contests a sample result, they must submit a rationale to EPA providing a justification, including a supporting statement from the laboratory.

EPA may invalidate samples if any of the following applies:

- The laboratory establishes that improper sample analysis caused the total coliform-positive result.
- EPA, on the basis of the results of repeat samples, determines that the total coliform-positive sample resulted from a non-distribution system plumbing problem. EPA cannot invalidate a sample on the basis of repeat sample results unless all repeat sample(s) collected at the same tap as the original total coliform-positive sample are also total coliform-positive, and all repeat samples collected at other taps are total coliform-negative (e.g., EPA cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative, or if the aircraft water system has only one tap).
- EPA has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the aircraft water system. The decision to invalidate, with the rationale for the decision, must be documented in writing and approved and signed by the supervisor of the EPA official who recommended the decision. EPA must make this document available to the public. The written documentation must state the specific cause of the total coliform-positive sample, and what action the system has taken, or will take, to correct this problem. EPA may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative.

As provided in 40 CFR 141.21(c), a laboratory must invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the Multiple-Tube Fermentation Technique), produces a turbid culture in the absence of an acid reaction in the Presence-Absence (P-A) Coliform Test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., Membrane Filter Technique). If a laboratory invalidates a sample because of such interference, the system must collect another sample from the same location as the original sample within 24 hours of being notified of the interference problem, and have it analyzed for the presence of total coliforms. The system must continue to re-sample within 24 hours and have the samples analyzed until it obtains a valid result. EPA may waive the 24-hour time limit on a case-by-case basis.

4.6 Reporting Sampling Results

Reporting of sampling results begins one-year after the final rule is published. As the primacy agency, EPA will oversee reporting by air carriers. To facilitate collection and

analysis of aircraft water system data, EPA is developing an internet based electronic data collection and management system. This approach is similar to that used under the EPA SDWIS/STATE (Safe Drinking Water Information System/State version) reporting program. Analytical results for microbiological testing will be reported directly to this database using Web forms and software that can be downloaded free of charge. The data system will perform logic checks on data entered and calculate final results for accountability and regulatory oversight. This is intended to reduce the reporting errors and limit the time involved in investigating, checking, and correcting errors at all levels.

Air carriers should instruct laboratories to either manually enter analytical results into an EPA-managed Web-based data system, or to electronically upload data files from their laboratory information management systems (LIMS) to a Web-based data file submission program. These data files must be in a format prescribed by EPA. If an air carrier determines that its laboratory does not have the capability to report data electronically, they can submit a request to EPA to use an alternate reporting format. If it is believed that a result was entered into the data system erroneously, the air carrier may notify the laboratory to rectify the entry.

All sample results must be reported to EPA no later than 10 calendar days following the monitoring period in which the sampling occurred. Remember that the length of the monitoring period depends on the coliform sampling frequency and may be monthly, quarterly, or annual sampling.

All events requiring notification to passengers and crew and non-routine disinfection and flushing must be reported within 10 days of the event triggering the notification or disinfection and flushing requirement. For example, once an air carrier is notified by the laboratory that a set of two routine coliform samples are positive for total coliform, the air carrier has 10 days to notify EPA of the event including an indication of whether required notification was provided to passengers and/or crew. The electronic database reporting system will include the capability and instructions to facilitate compliance with these reporting requirements.

Chapter 5 Operations and Maintenance Plans

This chapter describes ADWR requirements related to operation and maintenance (O&M) of the aircraft water system. The ADWR requires air carriers to update their FAA-approved or -accepted O&M program for each aircraft with procedures specific to the aircraft water system. This chapter includes example O&M practices used by some air carriers. These practices may not be applicable to all types of aircraft or all configurations of aircraft water systems.

5.1 Overview of Requirements and Timeframes

An O&M plan must be completed for each aircraft that is a public water system at the time of rule promulgation. For new aircraft added to a fleet after the rule promulgation date, the aircraft O&M plan must be completed by the end of the first calendar quarter during which the aircraft is placed into operation. In order to ensure that the appropriate multiple barriers are in place, each aircraft water system O&M plan must include the following components:

- **Watering Point Selection Requirement.** The O&M plan must include a statement that all water sources must from a FDA-approved watering point as required under 21 CFR 1240.80.
- **Procedures for Disinfection and Flushing of Aircraft Water System.** The O&M plan must include a description of disinfection and flushing procedures for aircraft water systems that are conducted in accordance with or are no less stringent than the manufacturer recommendations. This allows for equipment-specific designs and for flexible implementation of disinfection procedures with the evolution of technology. The description of disinfection procedures must include the specific disinfection frequency, disinfecting agent, disinfectant concentration, and disinfectant contact time. The description of flushing procedures must include the flushing volume or flushing time. EPA understands that some manufacturers do not provide equipment disinfection and flushing recommendations. Where a recommended routine disinfection and flushing frequency is not specified by the aircraft water system manufacturer, the aircraft water system must perform disinfection and flushing no less frequently than quarterly.
- **Procedures for Follow-up Sampling.** The O&M plan must include written procedures for conducting follow-up sampling, defined as additional sampling for coliform bacteria that is required by the ADWR following detection of total coliform, *E. coli*, or fecal coliform bacteria in routine or repeat samples. Follow-up samples are also required after corrective disinfection and flushing is performed when triggered by a failure to collect routine coliform samples.

- **Training Requirements.** The O&M plan must describe training requirements for all staff involved with the O&M provisions of the ADWR including water quality monitoring.
- **Self-Inspection Procedures.** Aircraft pre-flight inspections consider the safety of all passengers, the pilots, and flight attendants. EPA expects the same level of attention to be exhibited when air carriers conduct self-inspections of their aircraft public water systems. The O&M plan must describe how self-inspections of the aircraft water system will be conducted, including but not limited to: inspection of the storage tank, piping, supplemental treatment, plumbing fixtures, valves, and backflow prevention devices. Air carriers must report evidence of a self-inspection to EPA within 90 days of completion of the self-inspection, including an indication that all deficiencies were addressed. Copies must be made available to EPA during compliance audits. If any deficiency has not been addressed within 90 days of identification of the deficiency, the report must also include a description of the deficiency, an explanation as to why it has not yet been addressed, and a schedule for addressing it as expeditiously as possible.
- **Procedures for Boarding Water.** The O&M plan must include a description of how the water will be transferred from the watering point to the aircraft in a manner that ensures it will not become contaminated during the transfer. This description may be provided in a step-by-step procedure format, or other means which are useful to personnel responsible for the transfer process. This information will be helpful for ground crews responsible for maintaining the equipment supplying the aircraft with finished water. The plan must also describe emergency procedures to be used in the event that water is boarded that does not meet drinking water standards but is needed to operate essential systems, such as toilets. Those emergency procedures must include notification of passengers and crew, as described in Chapter 6; disinfection and flushing within 72 hours in accordance with the procedures in the O&M manual; and collection of follow-up samples. The plan must include a description of how the carrier will ensure that water boarded outside the United States is safe for human consumption.
- **Coliform Sampling Plan.** The O&M plan must include the monitoring plan for coliform bacteria. The coliform sampling plan is described in Chapter 4. Plan elements include but are not limited to:
 - Coliform sample collection procedures
 - Sample tap locations representative of the aircraft water system
 - Frequency of coliform sampling and number of samples to be collected during each sampling event
 - Frequency of routine disinfection and flushing
 - Procedures for communicating sample results

5.2 Routine and Corrective Disinfection and Flushing

As described in section 5.1, routine disinfection and flushing must be conducted at the frequency recommended by the manufacturer of the aircraft water system. If the manufacturer does not specify a frequency, the aircraft water system must be disinfected and flushed at least quarterly. Corrective disinfection and flushing must be conducted if *E. coli* or fecal coliform are detected in any sample, if two or more routine samples or any repeat sample is total coliform-positive, or if any follow-up coliform sample is total coliform-positive.

The following section summarizes example flushing and disinfection practices for aircraft water systems. Typical disinfectants and dosage rates are summarized in Table 5.1.

Table 5.1 Typical Disinfectants Used for Aircraft Water Systems

Disinfectant		Dosage Rate	Contact Time
Trade Name	Active Ingredient		
Purogene plus citric acid activator	2% chlorine dioxide	100 parts per million (ppm)	1 hour
Ozone	Ozone	1.5 ppm	20 minutes to 1.5 hours
Elsil	3% hydrogen peroxide	400 ppm	1 hour
Herlisil	50% hydrogen peroxide	400 ppm	1 hour
Chlorox, sodium hypochlorite, or calcium hypochlorite	chlorine	100 ppm	1 hour
Chlorox, sodium hypochlorite, or calcium hypochlorite	chlorine	50 ppm	4 hours

Recommended Disinfection Procedure

- 1) Open all taps and completely drain water system.
- 2) Remove filters and replace filter caps.
- 3) Make up disinfectant solution (disinfectant type and dose vary, see Table 5.1).
- 4) Fill water system tank with disinfectant solution until full (drains out of tank overflow).
- 5) Flush galley and lavatory taps until proper disinfectant concentration is measured at all taps.
- 6) Top off water system tank with disinfectant solution.

*Draft Technical Guidance Manual
for the Proposed ADWR – 7-02-08*

- 7) Hold disinfectant solution in water system for predetermined contact time (varies depending on disinfectant type and dose, see Table 5.1).
- 8) Record contact time and initial disinfectant concentration in maintenance records (Aircraft Maintenance Report).
- 9) Open all taps and completely drain water system.
- 10) If measured disinfectant concentration was less than required, or actual contact time was less than required, repeat disinfection procedure.
- 11) If disinfection procedure met requirements for disinfectant concentration and contact time, refill the water system with potable water and allow water to flow from each tap for 2 minutes.
- 12) Collect water samples for coliform bacteria if follow-up samples are required.
- 13) Repeat disinfection procedure if coliform samples are coliform-positive, or if water quality is otherwise unsatisfactory.
- 14) Install new filters.

In step 5, after the aircraft water system tank has been filled with the disinfectant solution, all lavatory and galley taps are opened in order to draw the disinfectant solution completely through all pipes and fixtures. Various procedures have been suggested to accomplish this step. For example:

- Flush galley and lavatory taps until disinfecting solution flows from the tap.
- Flush toilets 2 to 5 times with 15 second interval between flushes.
- Flush galley and lavatory taps for 3 minutes.
- Flush toilets 5 times.
- Flush toilets 15 times.
- Flush galley taps enough to run 5 liters of solution through the tap.
- Flush cold water tap in lavatory enough to fill sink, drain the sink, then flush hot water tap enough to fill sink.

When the aircraft is temporarily taken out of service, the water system is typically drained to prevent water quality degradation and to protect the system from frozen pipes during cold weather. Before the water system can be returned to service, it should be disinfected and flushed. One air carrier provided EPA with the following general recommendations/guidelines for water system maintenance associated with aircraft storage:

- 1) If the aircraft will be parked for more than three days, drain the water system. When it is returned to service, perform disinfection procedure, and then fill the lines with potable water.
- 2) If the aircraft will be stored (i.e., taken out of service), conduct the following prior to storage: drain the water system, perform the disinfection procedure, and then drain the water system again so that there is no water in the system while the aircraft is stored. Before the aircraft is returned to service, conduct the following: perform the

disinfection procedure, replace charcoal filters if installed, and fill with potable water and flush the lines.

5.3 Training of Personnel

Training is required for air carrier staff and contractors responsible for operating and maintaining the aircraft water system. This includes staff that board water; conduct sampling, disinfection, and flushing; and perform self-inspections. The training will emphasize the use of sanitary practices in operating and maintaining the water system in order to maintain water quality and to protect public health.

The aircraft water system O&M plan must describe the air carrier's program for training personnel responsible for O&M activities. The O&M manual can also serve as a training reference for personnel through inclusion of recommended operating procedures and guidance for making operational decisions. An up-to-date manual should always be accessible to operations staff.

The O&M plan should describe the following elements of the training program:

- Training topics and typical training schedule, including the frequency training that will be provided and duration of the training
- Training program for new staff
- Refresher classes for existing staff

Training topics for aircraft water system personnel should include:

- The public health and safety reasons for the ADWR requirements
- ADWR requirement details
- Acute contaminants, contaminant pathways, and control measures
- Procedures for boarding water
- Collecting water samples for coliform bacteria analysis and transport of samples to the laboratory
- Routine disinfection and flushing practices
- Procedures for taking aircraft out-of-service and returning to service (e.g., draining, disinfection, flushing)
- Performing self-inspections
- Draining and cleaning the storage tank
- Backflow prevention and cross connection control
- Water treatment equipment maintenance and replacement requirements

5.4 Procedures for Conducting Self-Inspections

The O&M plan must explain how self-inspections of the aircraft water systems will be conducted. The ADWR requires that a self-inspection be completed no less frequently than once every five years. The purpose of the self-inspection is to make sure that the aircraft water system is not compromised or subject to contamination.

It may be convenient to schedule the self-inspection when the aircraft is taken out of service for other regularly scheduled maintenance, such as a D-Check. A D-Check is a periodic maintenance check performed on all aircraft after a certain amount of time or usage. It is the most complete of the four types of maintenance checks and occurs approximately every 4-5 years. During a D-Check, the entire aircraft is essentially taken apart for inspection. Alternatively, the self-inspection could be scheduled after a certain number of flight hours. However, the ADWR requires that it occur no less frequently than once every five years.

Appendix D [TO BE DEVELOPED] provides a discussion of the essential elements of an aircraft self-inspection and an example checklist of items to be included in a self-inspection procedure. This checklist is provided as guidance for air carriers to assess their aircraft water system for potential problem areas and to assist them in preparing for a compliance audit by EPA.

Aircraft water systems are generally considered to include the following basic elements: a water service panel, a storage tank, treatment equipment (if any are on the aircraft), the distribution lines (piping and valves), and plumbing fixtures. A thorough inspection is needed to determine:

- Whether the system can provide a safe and adequate supply of drinking water to the passengers and crew
- The potential for degradation of the water quality or sanitary risks
- The system's reliability and vulnerability

The self-inspection example checklist is based on the eight essential elements of a public water system sanitary survey, with modifications appropriate for an aircraft water system. The eight elements of a typical sanitary survey include the following:

1. Source
2. Treatment
3. Distribution System
4. Finished Water Storage
5. Pumps, pump facilities, and controls
6. Monitoring, reporting, and data verification
7. System management and operation
8. Operator compliance with State Requirements

Although some of these elements may not directly apply to an aircraft water system, the self-inspection procedure is intended to provide the same degree of scrutiny for potential public health risks and reliability issues.

Specific reporting and recordkeeping requirements also apply to aircraft self inspections. Within 90 days of discovering a deficiency during a self-inspection, the deficiency must be addressed. In addition, within 90 days of completion of the self-inspection, the air carrier must report to EPA that it has completed the self-inspection and all deficiencies have been addressed. Any deficiencies that have not been addressed within 90 days of when they are identified must be included in the report to EPA, including a description of the deficiency and a schedule for addressing it as soon as possible.

5.5 Practices and Procedures for Boarding Water

5.5.1 Routine Practices

Water is transferred to aircraft at the airport's watering points using either water cabinets mounted on the airport terminal building or a mobile water cart or truck. The design, operation, and maintenance of watering point facilities are regulated by the FDA [21 CFR 1240 and 21 CFR 1250].

At a minimum, compliance with FDA regulations is required. It is also advisable to periodically check FDA's website (www.fda.gov) for updated information and guidelines. For example, at a future date, FDA is planning to have a list of approved watering points on their website.

An example of water boarding practices provided by the National Air Transportation Association (NATA) and Airline Services Council & Associates includes the following:

- 1) Persons known to have or suspected of having one or more of the following conditions are not allowed to conduct drinking water service for aircraft water systems:
 - a) Carrier of a communicable disease.
 - b) Suffering from a gastrointestinal disease/illness.
 - c) An open lesion or evidence of infection on exposed surfaces of body.
 - d) Personnel engaged in removal or disposal of wastes from aircraft or other airport facilities.
- 2) Personnel handling drinking water service equipment shall keep hands clean at all times.
- 3) Water service tanks and connected plumbing, hoses, hose reels, racks, and cabinets must be kept clean at all times.
- 4) All plumbing and hoses must be water-tight with no leaks.
- 5) All tank openings except the tank vent must be capped or plugged at all times except when being repaired or serviced or when tank is being filled.

- 6) The hose end that is connected to the aircraft water system must be carried to and from its storage place and never allowed to touch the ground. When not in use, the hose end must be plugged, capped, or attached to an approved storage fitting.
- 7) When not in use, hoses must be stored on a hose reel or suitable bracket to prevent kinking, damage, and contamination from dirt, oil, etc.
- 8) Prior to connecting a service vehicle to the aircraft water system, flush the system by running 5 to 10 gallons of water through it.
- 9) Thoroughly flush mobile water trucks and carts every 1 to 2 days.

Notes on typical system design:

- 1) Hoses for filling the aircraft drinking water tanks are 3/4 inch in diameter or less, and are equipped with a cap and keeper chain. They must meet FDA specifications.
- 2) All hose connections for servicing the aircraft drinking water system are a different size or type than those used for servicing lavatory facilities on the aircraft.
- 3) When hoses are transported on the drinking water servicing vehicle, storage facilities shall be provided on the vehicle to protect hoses from contamination.
- 4) Aircraft galley potable water tanks may be filled independently or from the main potable storage tanks aboard. If filling is to be from the main tanks, it shall be via a continuous, closed piping system. Shut-off valves may be installed in these lines. If filling is directly to the galley tanks, the water filling connection shall be quick-coupling, of a size or type different from other service connections on the aircraft (no greater than 3/4 inch). The connection shall be clearly labeled "Potable Water Filling" and be provided with properly secured protective dust-tight cover. The fill line shall be completely independent and not cross-connected with any line used for non-potable liquids.
- 5) If insulation is used to protect hoses from freezing, it must be protected to prevent water adsorption and contamination.

To prevent contamination of the drinking water during the water transfer and boarding process, the following specific guidelines are suggested:

- Daily checks for leaks, seals on fill ports, storage of fill hoses, and draining of tank dumps.
- Monthly checks of hose diameter (in relation to lavatory fill hose), tank vents, flushing and sanitizing of tanks, and "drinking water only" markings on vehicles.
- Attach cap to hoses.
- Use clean hands at watering point.
- Inspect watering point on regular basis.

5.5.2 Procedures for When Water of Unknown Quality or Contaminated Water Must be Boarded

EPA understands and recognizes that aircraft traveling overseas may board water from sources that are outside the jurisdiction of the United States. EPA is aware that a number of air carriers have procedures in place to provide assurances on the quality of water boarded from such sources. EPA is supporting an international effort led by the World Health Organization (WHO) to address the boarding of water from foreign countries.

The Agency is also aware that in limited circumstances, water of unknown quality is occasionally boarded to operate essential systems, such as toilets. When instances such as these occur, passengers and crew must be notified, access to the water must be restricted, disinfection and flushing of the aircraft water system must occur within 72 hours if the water system cannot be shut off from public access, and follow-up samples must all be coliform-negative before the water system can be accessible to the public. These are the same steps as are required in the event a fecal coliform or *E. coli*-positive sample is collected from the aircraft water system. EPA believes this will provide the best method of protection to the public health by minimizing the risks of exposure to unknown contaminants.

The ADWR requires that the O&M plan include emergency procedures to be used in the event that water is boarded to operate essential systems, such as toilets, but is not boarded from an FDA approved or otherwise safe watering point. In this situation, the public notification and disinfection and flushing requirements are similar to those for water of unknown quality, such as when routine samples are not collected.

It may be necessary for an air carrier to have different response plans for different types of aircraft if some aircraft have a separate water system for toilets and/or a separate water intake valve.

Chapter 6 Public Notification

6.1 Purpose of Public Notification

Public notification requirements of the NPDWRs are intended to alert consumers to potential health risks from violations of the drinking water standards or other situations that may present a health risk. Violations of the public notice requirements for stationary systems are divided into three tiers to take into account the seriousness of the violation or situation and any potential adverse health effects that may be involved. Public notices related to acute health risks are categorized as tier 1, and typically must be provided within 24 hours of identification of the violation. Because most of the violations or situations encountered by aircraft water systems pose potential acute health risks, notification is also typically required within 24 hours. Due to the transient nature of the public served by TNCWSs such as aircraft, public notice is often provided by posting the notice at locations where passengers and crew may access drinking water from the water system. Notification may also be given through written or verbal means.

Passengers and crew served by an aircraft water system have a right to be informed of problems with the drinking water. With proper notification, they can make choices about using the water based on their perception of risk. As mentioned in Chapter 3, water provided on aircraft must meet standards for human consumption, including uses such as hand washing and brushing teeth. Thus, even if bottled water is provided to passengers and crew for drinking, water in aircraft lavatories must still meet drinking water standards.

The right to know about drinking water problems extends not just to contamination but also to failure to perform required monitoring or maintenance. For example, when an air carrier fails to monitor, the quality of the water is unknown. If the carrier does not conduct routine disinfection and flushing, it cannot be sure the water system is adequately maintained.

6.2 Notification of Passengers and Crew

Air carriers must issue public notice to passengers and crew for all events described below [40 CFR 141.805].

- 1) **When public access to the water must be restricted due to the detection of fecal coliform or *E. coli* in one or more water samples, or if more than one coliform sample in a monitoring period is total coliform-positive.** In each of these situations, the ADWR specifies health effects language that must be included in the notice to the crew that explains the significance of the indicator organisms found in the water.

- 2) **Failure to conduct routine, repeat, and follow-up monitoring for coliforms.**
When routine monitoring is not completed, the water is considered to be of unknown quality. In this case, the notification advises passengers and crew that sampling did not take place and specifies the water may be used for handwashing, but not for drinking, teeth brushing, or food and beverage preparation. In contrast, when repeat or follow-up samples are not collected, the notification restricts all access to the water including handwashing. The content of the notice will be determined by the events that triggered the repeat and follow-up monitoring requirement.
- 3) **Water has been boarded from a watering point that is not FDA-approved or has not otherwise been determined to be safe.** Boarding water from a watering point that is not FDA-approved or has not otherwise been determined to be safe (as may occur when water is boarded from foreign water sources) creates a potential public health risk caused by water of unknown quality. The notification of passengers and crew advises only using the water for handwashing, but no other consumptive uses.
- 4) **The EPA, the air carrier, or the crew otherwise determine that public notification is necessary to protect public health.** Aircraft must also give notice for other violations or situations that could cause serious health effects as a result of short-term exposure. The EPA, the air carrier, or the crew may determine specific conditions exist that create a public health risk for which public notice is warranted. Public notice is required for other violations such as failure to perform disinfection and flushing, failure to perform coliform monitoring, or failure to restrict public access. An example of when notification might be necessary is if water must be boarded onto the aircraft but it is known to be contaminated or in violation of drinking water standards applicable to TNCWSs, such as when the public water system serving the airport has violated a coliform standard, surface water treatment technique, or nitrate/nitrite maximum contaminant level.

When public access to the water system is restricted, the ADWR requires the provision of alternatives to meet basic hygienic needs of passengers and crew as well as alternative sources of drinking water [40 CFR 141.803(c)(5)(iii)]. Bottled water must be provided for drinking and coffee/tea preparation, and antiseptic alcohol-based hand gels or wipes must be provided in the galley and lavatories. Other feasible measures that reduce or eliminate the need to use the aircraft water system during the period in which public access is restricted are also required. These additional measures are important for the protection of public health in that they assure basic sanitation needs are met. They are also important to ensure potable water is available to passengers and crew during flights when they are unable to access alternatives on their own.

6.2.1 Public Notice Methods and Timing

Air carriers must provide notification to passengers and crew within 24 hours of being informed of sample results that trigger notification, or within 24 hours of being directed by EPA to provide notification, whichever occurs first. The notification to passengers may be limited to the basic message, “the water is non-potable and should not be used for

drinking, food or beverage preparation, handwashing, teeth brushing, or any other consumptive use.” A more detailed notification is required for the crew. Notification must be reasonably calculated to reach all persons served by the aircraft water system and must be provided with one or more of the following forms of delivery:

- 1) Broadcast over a public announcement (PA) system on aircraft;
- 2) Posting of the notice in conspicuous locations (such as all the galleys and lavatories in the affected aircraft);
- 3) Hand delivery of the notice to passengers and crew; or
- 4) Another delivery method approved in writing by EPA.

All posted notices must continue and must remain visible until all follow-up coliform samples are negative for total coliform. Likewise, all public address announcements must be repeated on each flight until follow-up samples are negative for total coliform.

All events requiring notification to passengers and crew must also be reported to EPA within 10 days of the event triggering the notification, such as the air carrier being informed of sample results by the laboratory. This reporting must include an indication of whether the required notification was provided to passengers and crew. This does not require that a copy of a notification be provided to EPA. However, a copy must be available for EPA review as part of an audit. Copies of notices must be kept for at least three years after issuance. See Chapter 7 for more information on reporting requirements.

6.2.2 Public Notice Format and Content

Each notice to passengers:

- 1) Must be displayed in a conspicuous way when printed or posted;
- 2) Must not contain overly technical language or very small print;
- 3) Must not be formatted in a way that defeats the purpose of the notice;
- 4) Must not contain language that nullifies the purpose of the notice; and
- 5) Must contain information in the appropriate language(s) regarding the importance of the notice reflecting a good faith effort to reach the non-English speaking population served, including where applicable, an easily recognized symbol for non-potable water.

Notice to passengers is not applicable if access to the water is physically prevented by shutting-off of the water, or if water is supplied only to the lavatory toilets and not to any lavatory taps.

EPA also recommends that if public access to the water is restricted or limited to handwashing only, all paper cups or paper cones be removed from the lavatories and faucet areas to reinforce the message that the water should not be consumed.

In addition to placards or postings for aircraft passengers, each notice to the crew must provide complete information about the event or situation that triggered the notice. The ADWR requires additional information to be provided to the crew to ensure they are able to answer passenger questions, thoroughly understand the situation to appropriately implement restrictions and other activities, and make informed decisions regarding their exposure to the water. The notice provided to the crew must include the following elements:

- 1) A clear statement that the water is non-potable and should not be used for drinking, food or beverage preparation, hand washing, teeth brushing, or any other consumptive use;
- 2) A description of the violation or situation triggering the notice, including the contaminant(s) of concern;
- 3) When and where the violation or situation occurred;
- 4) Any potential adverse health effects from the violation or situation, as appropriate;
- 5) The population at risk, including sensitive subpopulations particularly vulnerable if exposed to the contaminant in the drinking water;
- 6) What the air carrier is doing to correct the violation or situation; and
- 7) When the air carrier expects to return to compliance or resolve the situation.

6.3 Required Language for Public Notification

The rule contains standard language that must be used for each situation where public notice to the crew is required. Standardized language ensures that the crew (and, indirectly, the passengers) receives a consistent message. This section provides the language for each type of situation.

Some of the standard language paragraphs contain bracketed sections. The brackets indicate where the necessary information specific to each event should be inserted, or where an applicable phrase could be selected. If the bracketed phrases request information, such as dates or number of samples, the required information should be inserted and then the brackets deleted. Including the language in this section does not completely fulfill the public notification requirements—all the elements described in section 6.2 must also be addressed.

Appendix B [TO BE DEVELOPED] of this manual contains samples of notices designed for posting. The text of an example public address announcement is included in section 6.4.

6.3.1 Detection of total coliforms only (not fecal coliforms or *E. coli*)

Use the following language when any routine or repeat sample is total coliform-positive, but is negative for fecal coliforms and *E. coli*:

Coliform are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. Coliforms were

found in [INSERT NUMBER OF POSITIVE ROUTINE AND REPEAT SAMPLES] samples collected and this is a warning of potential problems. If human pathogens are present, they can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

6.3.2 Routine or Repeat Sample Positive for *E. coli* or Fecal Coliform

Use the following language for any routine or repeat sample that is positive for *E. coli* or fecal coliform bacteria (note that in this situation, the notice for total coliform-positive samples is not also issued, even though these samples would have been total coliform-positive):

Fecal coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

6.3.3 Failure to Monitor, Improper Testing Procedures, or Failure to Disinfect and Flush

Public notices for monitoring, disinfection and flushing, or testing procedure violations must include the following text. Select the appropriate phrase from the options inside the brackets and delete the inapplicable phrases:

Because [REQUIRED MONITORING AND ANALYSIS WAS NOT CONDUCTED], [REQUIRED DISINFECTION AND FLUSHING WAS NOT CONDUCTED], [WATER WAS BOARDED FROM A WATERING POINT NOT APPROVED BY FDA] or [other appropriate explanation], we cannot be sure of the quality of the drinking water at this time. However drinking water contaminated with human pathogens can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems. This water may be used for hand washing, but not for drinking, food or beverage preparation, or teeth brushing.

6.4 Public Address Announcement for Positive E. coli Samples

Sample language for a violation involving an *E. coli*-positive sample is provided below. This is suggested language to be announced during each flight, but announcement of the violation is not required if the message is also posted or if public access to the water system is restricted.

The water on this aircraft is non-potable and should not be used for drinking, food or beverage preparation, handwashing, teeth brushing, or any other consumptive use.

Chapter 7 Recordkeeping and Reporting

This chapter discusses the recordkeeping and reporting requirements associated with the ADWR. The rule language can be found in 40 CFR 141.806 and 40 CFR 141.807 (see Appendix A).

7.1 Air Carrier Recordkeeping

Air carriers must keep records of information as specified below. The records retention system should be designed and organized to enable retrieval of specific records for each aircraft upon request by EPA. Records include hard copy or electronic files.

- Records of **bacteriological analyses** must be kept for at least 5 years. The following information must be retained:
 - The date, time and place of sampling, and the name of the person who collected the sample;
 - Identification of the sample as a routine, repeat, follow-up or other special purpose sample;
 - Date of the analysis;
 - Laboratory and person responsible for performing the analysis;
 - The analytical technique/method used; and
 - The results of the analysis.
- Records of **disinfection and flushing** must be kept for at least 5 years (see Exhibit 7.1 for example format and content)
- Records of **self-inspections** must be kept for at least 10 years
- Copies of **public notices** provided to passengers and crew must be kept for at least 3 years after issuance.
- Copies of **coliform sampling plans** must be available for review by EPA during compliance audits and upon request.
- Copies of aircraft water system **O&M plans** must be maintained in accordance with FAA requirements and available for review by EPA during compliance audits and upon request.

Exhibit 7.1 Example Format for Disinfection and Flushing Records

Aircraft Identification Number:

Date and Time	Routine (R) or Corrective (C)	Disinfectant Type and Dose	Contact Time	Completed by (Initials)	Follow-up Samples Collected (Date/Time)	Follow-up Samples Results

7.2 Reporting Requirements

All reporting to EPA must be submitted in an electronic format established or approved by EPA. If an air carrier is unable to report electronically, an alternative approach may be used if approved in advance by EPA.

[PLACEHOLDER FOR MORE INFORMATION ON THE DATABASE AND REPORTING FORMATS - THAT INFORMATION MAY WARRANT RE-WRITING OF THIS CHAPTER]

7.2.1 Coliform Sampling and O&M Plans

Although copies of coliform sampling plans and O&M plans must be retained, they are not required to be submitted to EPA. However, EPA must be informed when the plans are completed, or changed, and EPA may request a copy of the plan at any time.

In addition, for each aircraft water system, the proposed routine coliform sampling frequency must be reported to EPA. The frequency of coliform monitoring and routine disinfection and flushing will be tracked and compared to the minimum requirements of the rule for use as the basis for determining compliance with the provisions of the ADWR.

For existing aircraft, both sampling frequencies and coliform sampling plan completion must be reported to EPA within 6 months after final rule publication. For new aircraft placed into operation after promulgation of the ADWR, sampling frequencies and plan completion must be reported within the first calendar quarter of initial operation of the aircraft. See Chapters 4 and 5 for more information on coliform sampling and O&M plan requirements.

7.2.2 Aircraft Inventory

The air carrier must report its complete inventory of aircraft that are PWSs to EPA no later than six months after publication of the final rule in the *Federal Register*. Inventory information includes, but is not limited to the following:

- The unique aircraft identifier number;
- The status of the aircraft as active or inactive; and
- The type and location of any treatment equipment installed on the water system.

Any changes in aircraft inventory must be reported no later than 10 days following the calendar month in which the change occurred. Required information includes, but is not limited to the following:

- Status of aircraft water systems as active or inactive, and
- Type and location of any treatment equipment added to or removed from the water system.

See Chapter 3 for more information on reporting requirements.

7.2.3 Coliform Sampling Results and Violations

In most cases, all coliform sampling results (routine, repeat, and follow-up) must be reported no later than 10 calendar days after the end of the monitoring period in which the samples were collected. The monitoring period is based on the monitoring frequency identified in the coliform sampling plan and may vary for different aircraft in an air carrier fleet. Thus, the monitoring period could be one month, one quarter (three months), or 1 year.

If sample results trigger disinfection and flushing or public notification, the event must be reported to EPA within 10 days of being informed of sample results by the laboratory. Such events include any routine or repeat sample positive for *E. coli* or fecal coliform.

Failure to comply with the monitoring or disinfection and flushing requirements of this regulation must also be reported to EPA within 10 calendar days. Failure to comply with monitoring requirements includes, but is not limited to, failure to take routine samples according to the schedule in the coliform sampling plan, failure to take repeat samples and follow-up samples within the time required, and failure to use EPA-approved analytical methods. Failure to comply with disinfection and flushing requirements includes failure to perform routine disinfection and flushing according to the schedule in the O&M plan, and failure to conduct corrective disinfection and flushing.

7.2.4 Self-Inspection and Compliance Audit Results

Air carriers must provide evidence of a self-inspection to EPA within 90 days of completion of the self-inspection (self-inspections of aircraft water systems are required

every 5 years). The report must include an indication that all deficiencies identified in the inspection have been addressed.

If any deficiencies have not been addressed within 90 days of a compliance audit or self-inspection, the air carrier must report a description of each unaddressed deficiency, an explanation as to why it has not been addressed, and a schedule for addressing each deficiency as quickly as possible.

Chapter 8 Violations of the Rule

Implementation and enforcement of National Primary Drinking Water Regulations applicable to interstate conveyance carriers is a responsibility of the EPA. In addition, the ADWR allows for improved coordination of federal programs in the FAA and FDA to regulate aircraft water systems. This chapter describes violations of the ADWR.

When a violation of ADWR requirements occurs, several actions may be required including formal notification of the aircraft passengers and crew, corrective actions to bring the aircraft water system into compliance with the rule, and notification to EPA of actions taken. Exhibit 8.1 summarizes rule violations, public notification requirements and recommended corrective actions. The exhibit also provides references for further information.

Exhibit 8.1 Violations of the ADWR

Violation	Public Notice Required?	Corrective Action	Chapter Reference for Further Information	ADWR Reference
Failure to disinfect and flush. This includes failure to conduct routine disinfection and flushing as specified in the O&M plan and failure to conduct corrective disinfection and flushing.	Yes	(1) Notify passengers and crew as expeditiously as possible, but in no case later than 24 hours after discovery of failure to disinfect and flush or after being notified by EPA of failure to disinfect and flush, (2) conduct disinfection and flushing within 72 hours, (3) collect follow-up samples.	Chapter 4, Chapter 5	§141.810(a)(1)
Failure to monitor for coliforms. This includes failure to monitor according to the frequency in the coliform monitoring plan, along with failure to analyze total coliform-positive samples for fecal coliform or <i>E. coli</i> , failure to conduct repeat sampling after routine samples are found to be positive for total coliform, and failure to conduct follow-up monitoring after disinfection and flushing.	Yes	(1) Notify passengers and crew as expeditiously as possible, but in no case later than 24 hours after discovery of failure to collect required samples or after being notified by EPA of failure to collect required samples, whichever comes first, (2) conduct disinfection and flushing within 72 hours, (3) collect follow-up samples.	Chapter 4	§141.810(a)(2)
Failure to conduct a self-inspection or address a deficiency in accordance with your O&M plan. Self-inspections are required every 5 years. Deficiencies noted during self-inspections must be corrected within 90 days.	No	Conduct a self-inspection and provide evidence to EPA the self-inspection was completed. Report to EPA a description of any deficiencies not addressed, an explanation as to why it has not yet been addressed, and a schedule for addressing any deficiencies as expeditiously as possible.	Chapter 5	§141.810(b)(3)
Failure to develop a coliform sampling plan. Coliform sampling plans must be developed within 6 months of ADWR promulgation.	No	Develop a coliform sampling plan and notify EPA the plan has been completed.	Chapter 4	§141.810(b)(4)
Failure to develop operation and	No	Develop an operation and maintenance plan	Chapter 5	§141.810(b)(4)

Violation	Public Notice Required?	Corrective Action	Chapter Reference for Further Information	ADWR Reference
maintenance plan. -- For existing aircraft, O&M plans must be developed within 6 months of ADWR promulgation. -- For new aircraft, the air carrier must develop the operations and maintenance plan required by §141.804 within the first calendar quarter of initial operation of the aircraft.		and notify EPA it has been completed.		
It fails to perform any of the requirements in accordance with §141.803(c) – coliform sample results	Yes	Perform the requirements specified.	Chapter 4	§141.810(a)(3)
One or more fecal coliform-positive or <i>E. coli</i>-positive sample in any monitoring period (routine and repeat samples are used in this determination).	Yes	(1) Restrict public access to the aircraft water system as expeditiously as possible, but in no case later than 24 hours after being notified of the positive result by the laboratory; (2) Conduct disinfection and flushing prior to resumption of unrestricted public access to the aircraft water system, or no later than 72 hours if the aircraft water system cannot be physically disconnected/shut off to the crew and passengers; and (3) Collect follow-up samples.	Chapter 4	§141.810(a)(4)
Failure to provide notification to passengers and crew.	No	Implement the correction necessary to remove the need for public notification.	Chapter 6	§141.810(b)(1)
Failure to comply with the reporting and recordkeeping requirements.	No	Implement a reporting and recordkeeping process and procedure.	Chapter 7	§141.810(b)(2)

Chapter 9 Suggested Engineering and Management Practices

This chapter offers guidance on expanding engineering and management practices for aircraft water systems above and beyond the regulatory requirements to improve protection of public health. These suggested practices include water quality maintenance, supplemental treatment, operations and maintenance, recordkeeping and public notification. Although many of the recommendations may apply to a given aircraft water system or specific condition, all recommendations will not be applicable to all systems. Recommended practices may need to be modified to reflect the characteristics of an individual system.

9.1 Maintaining Water Quality

Disinfection Residual

Maintaining a disinfectant residual in the water distribution system can have several benefits including inactivation of microorganisms and controlling biofilm growth. It provides health protection in the event that a contaminant such as a waterborne pathogen enters the water system.

The operation of an aircraft water system can potentially decrease the disinfectant residual in the boarded water. If the water is held in the system for an excessive period of time, the disinfectant residual may decrease. Although the aircraft water system is exposed to various levels of atmospheric pressure during flight, there is no documented evidence that these pressure changes affect water quality or the disinfectant residual. Onboard treatment devices may potentially affect the water's disinfectant residual. Contact the treatment system manufacturer to determine if there is any effect on the disinfectant residual.

Disinfectant residual monitoring is not required by the proposed ADWR because aircraft may board water from multiple locations, some of which may use groundwater supplies that are not required to maintain a disinfectant residual. However, some air carriers may choose to monitor disinfectant residual in the aircraft water system to collect additional information on water quality and potential public health risks. A low disinfectant residual or no residual may prompt the air carrier to conduct voluntary flushing and refilling the aircraft water system with water containing a disinfectant residual. This information may also help the air carrier determine the appropriate frequency for periodic system flushing and disinfection, to warn of potential contamination when disinfectant residual suddenly decreases, and as a general measure of water quality. Disinfectant residual monitoring is inexpensive and easy to perform in the field using industry standard methods.

Recommendations for booster (supplemental) disinfection systems are discussed below with other supplemental treatment topics.

Water Age Management

Under certain conditions, the design and/or operation of aircraft water systems can cause water to be held for excessive periods of time. Increased water age is a major factor in water quality degradation such as formation of disinfection byproducts (DBPs), accumulation of sediments, microbial growth such as biofilms, nitrification, taste and odor problems, and increased disinfectant decay.

Some air carriers allow “topping off” or adding water to the onboard storage tank without draining it. This practice can cause stored water to have a longer water age. Many air carriers have existing procedures for draining a water system if the aircraft is going to be parked for an extended period of time or due to air temperatures. These practices protect the aircraft water system piping from breakage due to freezing, and also help to minimize water age. Draining of tanks every three days is a common practice for some air carriers.

Recommended practices to minimize water age include the following:

1. Drain and refill tank every day if air temperature is above freezing.
2. Due to the weight of water, air carriers typically limit the amount carried to what is needed but this also is a good practice for minimizing water age.
3. Periodic flushing and disinfection per manufacturer’s recommendations is required, but may be appropriately practiced more often than recommended.
4. Increase the draining interval at airport locations with higher air temperatures where aircraft are parked overnight or long-term.

Biofilm Management

“...a water distribution system biofilm is a complex mixture of microbes, organic and inorganic material accumulated amidst a microbially produced organic polymer matrix attached to the inner surface of the distribution system....Biofilm likely exist in all distribution systems and are accepted as a normal part of the distribution system.” (USEPA OGWDW 2002). Biofilm can entrain substances in the water including waterborne pathogens, and later release these substances into the water, causing water quality problems such as tastes and odors, and increased disinfectant demand. Biofilm can protect microbes from disinfection, can increase pipe corrosion and can affect pipe hydraulics. Microbes can enter distribution systems through physical gaps in the distribution system piping or tank, or due to contamination during the water transfer process at the airport. Microbial growth and biofilm development are a concern when aircraft water system experiences excessive water age, higher temperatures, and when nutrients are present in the water.

9.2 Considerations for Supplemental Treatment

In cases where supplemental treatment is added to an aircraft, an additional barrier against contamination will be provided and potential risks to public health may decrease. Aside from charcoal/carbon, canister, and particle removal filters in some galleys and

lavatories, the majority of aircraft do not provide additional treatment for boarded water. Barriers to installing supplemental treatment include the cost of treatment units (*e.g.*, ultraviolet light disinfection systems) and the logistical challenges to install them in aircraft.

Some new aircraft are manufactured with water purification systems onboard. These systems are operating under the assumption that they are treating potable water and are in addition to any requirements to be included in the Aircraft Drinking Water Rule. In other cases, an air carrier may decide to add supplemental treatment to an existing aircraft water system to improve drinking water quality. In both new and existing aircraft, the design and installation of water treatment components must be approved by FDA.

9.3 Considerations for Supplemental Operator Training and Maintenance

Training operations and maintenance personnel on the details of supplemental treatment equipment installed on aircraft water systems is an important part of ensuring the equipment is properly installed, maintained, and inspected. Manufacturer's recommendations for installation and maintenance, as well as any troubleshooting concepts should be reviewed periodically and incorporated in to the training program as well as the operations and maintenance plan for the aircraft.

The consequences of improperly installed treatment equipment can include contributing to the degradation of the quality of the water, such as when biofilm growth is encouraged or protected by the device.

9.4 Considerations for Supplemental Recordkeeping

Water Boarding Locations/Volume Records

An effective system of communication is critical amongst air carriers, the PWSs that provide drinking water to the airports, and the airports. If an air carrier were to receive advance notice that water did not meet drinking water standards, they may be able to plan water boarding at alternate locations. Procedures for handling water contamination events should be part of both airport and air carrier emergency response plans. Also, it is critical that the airport emergency response coordinator ensures that the operator for the PWS that serves the airport knows who to contact at the airport in the event of a water emergency such as a treatment failure or a water main break. Likewise, air carriers must ensure that airport authorities know who to notify at each air carrier in the event of a water contamination event.

Air carriers are not currently required to record the volume of water boarded onto aircraft, the date/time of boarding or the location of boarding. This information may be valuable to the airline in the event that onboard water is later implicated in a public health problem, or the onboard water is tested and found to contain coliform bacteria. If the water can be traced back to a particular location, the water quality issue could be traced

back to the source of the problem and resolved, thereby limiting the number of aircraft water systems that board the problem water.

References

USEPA Office of Groundwater and Drinking Water. 2002a. Health Risks From Microbial Growth and Biofilms in Drinking Water Distribution Systems. Available at: http://www.epa.gov/safewater/disinfection/tcr/pdfs/whitepaper_tcr_biofilms.pdf .

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